elementary science. The preponderance of opinion amongst the teachers examined is that no subject is better calculated to awaken the interest and the intelligence of the scholars than science. So far as the present teaching of elementary science is concerned, it is in a most unsatisfactory condition. Mr. J. F. Buckmaster says that, in comparison with forty years ago, this department of school work has retrograded; and Sir Henry Roscoe agrees with the statement that the teaching of this subject is falling off. According to the latter witness, our system of education is intended to form clerks and not artisans: it is purely a literary system; and if we wish to preserve our manufacturing supremacy it must be changed. In fact, whatever has been done by the manufacturers and artisans of this country is owing in no degree whatever to the educational system, which rather retards industrial progress than otherwise; whilst on the Continent, where manufactures have made such strides of late, everything is owing to the technical schools and the scientific training of those intended for artisans. The vast majority of Board-school boys are intended for the workshop rather than the office: why, then, not fit them for the ordinary duties of life? If this be the object of elementary education—that is, the fitting of scholars in general for those duties which they will most probably be called on to perform—then, the Report says, elementary instruction in science is only second in importance to elementary instruction in reading, writing, and arithmetic. But the fact is, that though girls get some kind of training in, for example, needlework and cookery, there is no such thing as technical instruction for boys. Science, especially mathematical, mechanical, and physical science, is not only the foundation, but an essential part of technical instruction. With regard, however, to the teaching of science, certain warnings are necessary. In the first place, science teaching should not be allowed to interfere with the scholar's general instruction—that is, it should not be introduced too early in life. In the next place, the average teacher is useless as a science master. Even when by previous training the teacher is suited, he has scarcely time to devote to the preparation necessary to lecture clearly and to perform experiments accurately and neatly. Therefore, the Report suggests, the example of London, Liverpool, and Birmingham should be followed by School Boards, in engaging the services of a skilled science lecturer, who will go from school to school in a specified district. For example, in Birmingham, according to the evidence of Dr. Crosskey, the Chairman of the School Management Committee of that town, the demonstrator or an assistant visits each boys' and girls' department once a fortnight. He takes four departments a day, two in the morning and two in the afternoon. Two and a half hours a fortnight are given to science. The class teacher is present during the lecture, and recapitulates it to his scholars, who are bound to bring him written answers to questions thereon. Mechanics or elementary natural philosophy are the favourite subjects with boys,—sometimes they are taught electricity and magnetism; and the girls, domestic economy, considered as the application of chemistry and physiology to the explanation of matters of home life, and sometimes animal physiology. Not only have very great results been achieved by this system in the percentage of passes, but it is noticeable that the attendance is always largest on "science" days. Three years ago a lecturer was appointed for the East End of London, and he had at one time as many as two thousand boys under instruction in mechanics alone. The work has been so successful that three assistants have been appointed. Many witnesses justly complained of the kind of examination papers set in elementary science. One paper of questions is given at length in the Report. It is for boys of the Fifth Standard—that is, for boys between eleven and twelve—and consists of seven questions, of which a specimen, taken at random, may be given: "Quest. 2. In what bodies may you say that molecular attraction is balanced by the repulsive force of heat?" and written answers had to be given. Hence the suggestion of many experienced witnesses that younger children should be examined orally is taken up and recommended by the Commission.

Our system, or rather want of system, of education in elementary science is spoken of by the Commission as introductory to the wider subject of manual and technical instruction, to which they devote many pages of their Report. Into this we shall not follow them, but content ourselves by quoting a few sentences from the Report. "If it should be thought that children ought to receive some instruction in manual employment, other than that which the elementary schools available for their use can give, we are of opinion that the best way of meeting the need would be through the establishment of a workshop in connection with some higher institution, which might be willing to receive into the workshop boys of exceptional ability, or others to whom it was considered desirable to give this instruction. One such central institution could do its work better and cheaper than a number of scattered institutions, whilst nothing could be easier than to make arrangements for attendance at this central workshop being substituted on one or two afternoons in the week for attendance at the elementary school." To illustrate what might be done in this way, the case of the Seventh Standard School at Birmingham is quoted. This is to some extent a technical school, and no pupil is admitted unless he has previously passed in Standard VI. The subjects taught are reading, writing, and arithmetic, according to the Code; and, in addition, mathematics, plane geometry and projection, machine construction and drawing, magnetism and electricity, theoretical and practical chemistry, freehand drawing, and the manipulation of wood-working tools. These subjects are not generally taught to all pupils, but are divided into three divisions, to one of which, as a rule, the student confines his attention. The first division is the machine construction division, and includes mathematics, projection, machine construction, electricity, freehand drawing, and workshop; the second division is the chemistry division, and includes mathematics, projection, chemistry (theoretical and practical), freehand drawing, and workshop; the third division, the electricity division, includes mathematics, projection, theoretical chemistry, electricity, freehand drawing, and workshop. In the second year (the course is three years in duration) the scholars spend three hours a day in the workshop. This system, it is said, has produced excellent results.

NOTES.

THE Council of the Royal Meteorological Society have arranged to hold at 25 Great George Street, Westminster (by permission of the Council of the Institution of Civil Engineers), on March 19–22 next, an Exhibition of Instruments connected with atmospheric physics invented during the last ten years, especially those used for actinic and solar radiation observations. The Exhibition Committee invite the co-operation of all who may be able and willing to send contributions. The Committee will also be glad to show any *new* meteorological instruments or apparatus invented or first constructed since last March; as well as photographs and drawings possessing meteorological interest.

WE learn that Prof. Fitzgerald and Mr. Trouton have been conducting experiments confirmatory of Hertz's magnificent work. Lately, using parabolic mirrors after the manner Hertz recently described, they have observed the phenomenon of the polarization of radiations by reflection from a wall 3 feet thick. They observed long ago, and exhibited publicly at the opening meeting of the Experimental Science Association last November, that stone walls are quite transparent to these radiations, as they should be, and consequently should not reflect radiations polarized perpendicularly to the plane of incidence at a certain incidence. This is what has been observed, and it has been decided that the plane of polarization is the plane of the magnetic disturbance. They next tried reflection from sheets of glass, and obtained no results; but, as Mr. Joly suggested, the experimenters were practically observing the black spot in Newton's rings, for the sheet of glass was much thinner than a wave-length, which is about 30 centimetres. Some rough observations at various incidences from the wall seem to show interference at some and not at other incidences due to the same cause as Newton's rings.

The German Government have granted the sum of £27,500 to repair the building of the University of Berlin, and to erect new lecture-rooms, staircases, and corridors, and for the heating and lighting apparatus. The Government have also given £36,500 to the Natural History Museum, besides £2500 for books. A further sum of £1000 is to be devoted to the purchase of physical apparatus and an anatomical cabinet.

At the Epidemiological Society, on February 13, Mr. Victor Horsley will read a paper, illustrated by lantern photographs and micro-photographs, on "Rabies, its Treatment by M. Pasteur, and its Detection in Suspected Cases."

A technical laboratory for special instruction in dyeing and bleaching has just been opened in connection with University College, Dundee. This technical portion of the chemical department consists of a completely fitted dye-house, a laboratory, and a museum for technical samples, more especially connected with the textile industries of the district. Practical instruction in the dye-house was begun by Prof. Percy Frankland last week.

The *Kew Bulletin* for February consists of a list of such hardy herbaceous annual and perennial plants as have matured seeds under cultivation in the Royal Gardens, Kew, during the year 1888. These seeds are available for exchange with colonial, Indian, and foreign botanic gardens, as well as with regular correspondents of Kew. The seeds are for the most part available only in moderate quantity, and are not sold to the general public. The compiler points out that, as compared with the list previously published (*Kew Bulletin*, February 1887), the number of names inserted in this list is far fewer. This, he says, has arisen on account of the unfavourable conditions experienced during the summer of 1888, when, owing to prolonged rains and absence of sunlight, many plants did not mature seed.

We learn from *Petermann's Mitteilungen* for January that a Central Meteorological Institute was established on April 7, 1888, at San José, Costa Rica, under the Ministry of Instruction, with Señor Pittier as Director.

An Intercolonial Meteorological Conference was held at the Melbourne Observatory from September 11–15 last, under the presidency of Mr. R. J. Ellery, all the Australian colonies, New Zealand, and Tasmania, being represented. The Chairman stated that the chief object of calling the Conference together was "with a view of improving the intercolonial weather system, and for the advancement of Australian meteorological science generally." The following are among the principal resolutions adopted: (1) that the amount of information sent by telegraph should be reduced as far as possible, by reducing the number of stations; (2) that, with the telegrams, a forecast be sent from each colony for that colony; (3) that no meteorological forecast or prediction made in one colony and having reference to any other colony shall be communicated by telegraph to any other person or destination than the meteorologist of the colony to which such prediction refers. This motion was carried with one dissentient, Mr. Wragge. A long discussion ensued as to the best mode of thermometer exposure. Mr. Todd stated that he had fully tested the Stevenson stand; he thought it was quite impossible for anyone to say positively what was the best form of exposure. He was going to adopt the Stevenson screen for his out-stations, but was not necessarily going to put it only 4 feet from the ground. The Conference generally agreed that they should all work towards uniformity in the matter as far as possible. On the question of the supply of self-registering instruments to certain stations, Mr. Russell said that he had found the most diverse results from Richard's instruments; some gave satisfactory results, and others were perfectly useless. Sir James Hector said he had been fortunate with the instrument; as an assistant to reading the weather, it was most efficient. On the question of cloud nomenclature the forms given by Mr. Abercromby were approved of; the Chairman urged the importance of having them lithographed in colours, and he undertook to get copies of Mr. Abercromby's photographs so prepared, and sent round for approval to the members of the Conference. Various other questions were discussed, including the connection of climatological observations with hygiene, and the reduction of barometer observations to sea-level.

French students of ethnography are much interested in the group of Lapps who are at present being exhibited at the Jardin d'Acclimatation, Paris. The other day the group was increased by one, a daughter having been born. The new-comer is called "Parisienne."

The Geographical Society of Paris has just opened an interesting exhibition of photographs, dresses, weapons, boats, and other objects brought a short time ago from Greenland by M. Charles Rabot.

For many years the Kazan Society of Naturalists has devoted a good deal of attention to its collection of skulls, which is now one of the richest collections of the kind in Russia. Dr. Malieff gives, in the Memoirs of the Society (vol. xix. 2) a catalogue of the collection, with the chief measurements and indexes of each skull separately. The Slavonian and Russian skulls—partly from the seventeenth and eighteenth centuries, and partly more recent—are the most numerous; they number about three hundred. The old Bulgarian skulls, represented by thirty-seven examples, come next. The Permians, the Votyaks, the Tchuvashes, and the Tcheremisses are well represented. The like may be said of the Mordovian and the old Finnish skulls derived from the grave-mounds (*kurgans*). The Tartarian skulls are represented both by samples found in *kurgans*, and by modern specimens. Eighteen Kazan skulls found at Astrakhan are especially worthy of note.

Russian botanists are busily exploring the floras of the various divisions of the Empire, and the number of floras of separate provinces is rapidly increasing. At the same time, they are devoting closer attention to the delimitation of the various floras of European Russia, their chief efforts being directed towards the establishment of the separation lines between the flora of the black-earth or steppe region, and the flora of the forest region. M. Korzchinsky's new work on the northern limits of the former in the Government of Kazan, accompanied by a map which illustrates the conclusions of the author, is a valuable contribution to the subject (Memoirs of the Kazan Society of Naturalists, vol. xviii. 5). Full lists of the species characteristic of separate districts are given, together with a review of the literature dealing with the phenomena. Contrary to views formerly maintained, the author holds that in Eastern Russia there is no such separate flora as might be considered intermediate between the forest and the steppe floras, and that the latter penetrates within the forest region in the shape of isolated and well-defined oases; while a mixed vegetation, containing species characteristic of the steppes, intermingled with representatives of the meadows of the forest region, is met with only sporadically on the banks of some rivers, on the southern slopes of some hills, or on the outskirts of the forests. He distinguishes, on the contrary, a vegetation which has its own special characters over very wide tracts—from Astrakhan to Yaroslav—and is met with on the banks of the Volga, Kama, and Vyatka, as well as on the banks of the lakes which formerly were connected with the rivers and their old beds.

THE *Annuaire du Bureau des Longitudes* for 1889 contains the usual astronomical and physical tables, and much useful information relating to meteorology and other subjects. There is an admirable list of variable stars, with their positions corrected for 1889, and the dates of maxima and minima. The particulars of cometary orbits are brought up to Olbers's comet of 1887. With the exception of the memoirs at the end, however, there is little novelty. M. Tisserand contributes a very useful paper on the measurements of the masses of celestial bodies, including planets, asteroids, satellites, comets, and binary systems; a better account of the application of the laws of gravitation to this purpose would be difficult to find. Perhaps the most interesting paper is that contributed by M. Janssen, on his memorable expedition to Mont Blanc for the purpose of deciding whether certain lines in the solar spectrum are due to oxygen in our air or in the solar atmosphere. The results of the observations made on Mont Blanc showed that these lines were due to our own atmosphere, as they were weaker there than at lower levels.

WE have received the *Annuaire de l'Académie Royale de Belgique* for 1889, this being the fifty-fifth year of publication. Besides the academical calendar for the year, it contains a general history of the organization and all particulars relating to each department. It also gives accounts of the Commissions delegated to superintend the publication of national biography and history. Details of the prizes and medals at the disposal of the Academy, and the recipients of them from the dates of their institution, are also given. About 340 pages are devoted to biographical notices of deceased members, which are accompanied by admirable portraits, and full particulars of the works of each. It is interesting and gratifying to note the frequent occurrence of "Leopold II., Roi de Belgique," in connection with the work of the Academy.

ANOTHER important paper is contributed by Prof. Emil Fischer and Dr. Tafel to the number of the *Berichte* just received, upon the syntheses of glucose and mannite. Not only has the method of synthesizing glucose been perfected, and large yields of it obtained, but it has also been shown to ferment with yeast like natural glucose, and also like glucose to yield, on reduction with sodium amalgam, the hexhydric alcohol mannite. The first process by which the synthesis was effected, and which was fully described in NATURE, vol. xxxvii. p. 7, consisted in treating acroleïn dibromide with baryta-water, the sugar left in solution being afterwards precipitated by phenyl hydrazine in the form of a peculiar compound with the latter substance of the composition $C_{18}H_{22}N_4O_4$. This phenyl hydrazine compound was then reduced with zinc dust and acetic acid, the product being a base which, on treatment with nitrous acid, parted with its nitrogen, leaving a solution from which glucose was extracted by means of absolute alcohol. This method of obtaining glucose from the phenyl hydrazine compound was both exceptionally difficult in manipulation, and gave a very small yield of the sugar. The Würzburg chemists have recently discovered a far better process. The finely-powdered phenyl hydrazine compound is warmed with concentrated hydrochloric acid, when it dissolves to a clear dark red liquid. On cooling, phenyl hydrazine hydrochloride crystallizes out and is filtered off. The diluted filtrate is neutralized with hydrated lead carbonate, decolorized with animal charcoal, again filtered, and the solution made slightly alkaline with baryta-water. A syrupy substance of the constitution $CH_2OH . (CHOH)_3 . CO . COH$, which differs from glucose in possessing two atoms of hydrogen less, is at once precipitated in combination with lead. The precipitate is next treated with sulphuric acid and again neutralized with barium carbonate. The filtered solution, at last obtained almost pure, is evaporated *in vacuo* upon a water-bath, and the syrup extracted with absolute alcohol; on evaporation of the alcohol, the syrup is left behind in the pure state, and solidifies on cooling to a hard amorphous mass. It is only necessary now to reduce the aqueous solution of this syrup with zinc-dust and acetic acid, when the two additional hydrogen atoms are taken up and glucose formed. The zinc is precipitated from the filtered liquid by sulphuretted hydrogen, and the filtrate evaporated *in vacuo* upon the water-bath. On extraction of the syrup with absolute alcohol, and subsequent addition of ether, the sugar is precipitated in colourless flocculæ, which rapidly coalesce into a sweet-tasting syrup of pure glucose. By this method so large a yield has been obtained that fermentation experiments have been possible; and with beer-yeast this artificial glucose is found to rapidly ferment, evolving abundance of carbonic anhydride at the ordinary temperature. It reduces Fehling's solution, and only differs from natural dextrose and lævulose in being optically inactive, consisting, as it probably does, of a mixture of equal molecules of the right- and left-handed varieties. Further, by action of sodium amalgam, it is readily reduced to a compound of the formula $C_6H_{14}O_6$, which crystallizes in fine plates and melts at 165°; in fact, possesses all the properties of the hexhydric alcohol, $C_6H_8(OH)_6$, mannite.

THE *Board of Trade Journal* publishes a memorandum which has been drawn up in the Fisheries Department of the Board of Trade relative to the Sea Fisheries Regulation Act, 1888. The memorandum says that the Board of Trade may on the application of any county or borough Council create a sea fisheries district, and define its limits, and provide for the constitution of the local committee, which body is to have power to make by-laws regulating sea-fishing and oyster-fishing, to impose fines and forfeitures for the breach of such by-laws, and to appoint fishery officers for enforcing the observance of the by-laws within the district. Fishery officers will be empowered to search any vessel or vehicle used in fishing or in conveying fish.

THE *Zoological Record* for 1887 has just been issued. The editor is Mr. Frank E. Beddard. He explains that the only alteration of importance in the present volume is that authors' names have been printed throughout in capitals. It will be found that this renders clearer the references in the systematic part of the several records.

WE have received the first number of *Art and Literature*, published by Messrs. Maclure, Macdonald, and Co., Glasgow. It is well printed and illustrated, and the only fault we have to find with the new venture is that the word "Science" is not included in the title.

THE fourth part of Cassell's excellent "New Popular Educator" has been issued. This part, which contains contributions to the study of geography, physical geography, physiology, astronomy, and other subjects, is accompanied by a map of England, and is well illustrated.

A VALUABLE bibliography of Indian geology has been compiled by Mr. R. D. Oldham, Deputy Superintendent of the Geological Survey of India. It contains a list, as nearly complete as possible, of books and papers relating to the geology of British India and adjoining countries, published previous to the end of the year 1887.

ARNOLD GUYOT'S "Earth and Man" has been recently published for the first time in French. The French edition is not a rendering from the English; it is the original from which the English edition was translated.

AT the monthly meeting of the Royal Institution of Great Britain, on February 4, the special thanks of the members were returned to Mr. William Anderson for his present of a portrait of Prof. Mendelejeff.

IT is reported from North Central Norway and Sweden that wolves are very numerous this winter. They have reappeared in districts where they have been unknown for many years.

THE beaver is getting very scarce in Sweden, but recently a colony has been discovered near the mountain Middagsfjeldet, in the province of Jemtland, in the heart of Sweden.

IT is reported from the districts around the Christiania Fjord that sparrows have almost completely disappeared from those parts this winter.

SOME French students in Paris are distinguishing themselves by wearing a peculiar cap, the *béret* of the Pays Basque, to which is joined a small badge, varying in colour according to the Faculty or School (Scientific, Literary, Law, Medical, &c.) the possessor belongs to. The students of Montpellier have been better inspired in reviving the cap worn in the old school at the time of Rabelais.

WE have received the Calendar for the current academical year of the Imperial University of Japan. The record of events for the past year notes that in June the Tokio Observatory was founded. It is formed by the amalgamation of the University Observatory, the Astronomical Section of the Home Department, and the Astronomical Observatory of the Imperial Navy; the whole being placed under the control of the University, which is now intrusted with the duty of publishing the Astronomical Almanac. By a new arrangement, also, the income of the University from tuition fees and other minor sources is for the present to be accumulated year by year with the object of forming a capital fund for future use. The same is to be done with the fees of other educational institutions under the Education Department. At the time when the Calendar was issued, 276 students were attached to the Faculty of Law, 246 to that of Medicine, 91 to Engineering, 45 to Literature, and 36 to Science. The total number of graduates was 954.

THE additions to the Zoological Society's Gardens during the past week include a Golden Eagle (*Aquila chrysaëtus*), European, presented by Mr. Thos. Barclay; an Alligator (*Alligator mississippiensis*) from Florida, presented by Mrs. G. Peacock; two Himalayan Monauls (*Lophophorus impeyanus*) from the Himalayan Mountains, deposited; an Aard Wolf (*Proteles cristatus* juv. ♂) from South Africa, purchased.

OUR ASTRONOMICAL COLUMN.

THE COLOURS OF VARIABLE STARS.—In his new Catalogue of Variable Stars, noticed in NATURE, vol. xxxviii. p. 554, Mr. S. C. Chandler gave to each star a number indicative of the depth of the red tinge in its light, and in a more recent paper he has explained how these numbers were obtained. Two independent methods were followed: the first, the one proposed by Klein, and adopted by Schmidt and Dunér, in which the stars were arranged according to a scale on which 0 corresponded to pure white light, 1 to the slightest perceptible admixture of yellow with the white, and so on with 4 for full orange, and 10 for the purest red light known to us amongst the stars, and as seen in such examples as R Leporis. In spite of the vagueness of the definition of this scale, Mr. Chandler found by experience that the process of thus referring the impressions of colour to these imaginary standards could be effected with greater precision than he had supposed, or would naturally be inferred by an observer previous to trial. His second method seems, however, to promise more precision, and is both simple and ingenious. It consisted in estimating the relative change in brightness effected in two stars by the interposition first of a blue, and then of a red, shade-glass. Thus, supposing a red and white star appeared of the same brightness when viewed without any shade-glass, the white star would seem decidedly the brighter when the blue glass was used, but the fainter when the red glass was interposed, and these differences could be very precisely estimated by Argelander's method, and thus afford definite measures of the differences in colour of the two stars; of course, on an arbitrary scale depending upon the shade-glasses employed. In all, 665 estimates upon 108 telescopic variables were made by the first method, the "decimal scale" method; and 287 "relative diminution estimates," as Mr. Chandler terms his second method, were made upon 77 of the same stars. The mean of the two methods, equal weight being given to each separate observation, was given as the value of the redness of the star in the Catalogue.

Two somewhat important results appear from these observations: first, that the observations are evidently not affected by any serious systematic error depending on the magnitude, for on the average the same colour is given both at maximum and minimum, the recorded differences being small in amount and of varying sign. It would appear, therefore, that the change in the magnitude of a variable does not usually involve a change in its colour. This is an important point, as the more general opinion hitherto has been that such a change does generally take place. The second result is the intimate connection that exists in a variable between length of period and depth of colour. The Algol type stars are strikingly white; the very short-period stars are colourless, or nearly so; and those of longer period show a deeper red the greater the duration of their periods.

NEW MINOR PLANETS.—A new minor planet, No. 283, was discovered by M. Charlois, of the Nice Observatory, on January 28. This is M. Charlois's fourth discovery.

COMET 1888 *e* (BARNARD, SEPTEMBER 2).—The following ephemeris for Berlin midnight is in continuation of that given in NATURE for 1888 December 27 (p. 211):—

1889.	R.A. h. m. s.	Decl. ° ′	Log *r*.	Log Δ.	Brightness.
Feb. 9	23 42 28	4 28·0 S.	0·2598	0·4096	2·6
11	23 41 51	4 18·5			
13	23 41 18	4 8·9	0·2608	0·4196	2·5
15	23 40 47	3 59·3			
17	23 40 19	3 49·7	0·2621	0·4284	2·4
19	23 39 54	3 40·1			
21	23 39 31	3 30·5	0·2637	0·4362	2·3
23	23 39 11	3 20·9			
25	23 38 52	3 11·3 S.	0·2656	0·4429	2·2

The brightness at discovery is taken as unity.

HAYNALD OBSERVATORY (HUNGARY).—The results of the observations of solar prominences at this Observatory during the year 1886 have just been published (Kalocsán, 1888). The observations were made with a telescope of 190 millimetres aperture, and a spectroscope consisting of six flint glass prisms. The chief object was to determine the dimensions of metallic prominences, and their relations to sun-spots. Tables showing all the details of the observations, and the daily and monthly means are given. Prominences less than 20″ in height have been neglected. There are also three plates—the first showing the forms of some of the largest prominences observed, and the second indicating the state of the chromosphere for each day of observation between September 1 and October 31. The third plate, showing the relation of the heights of the prominences to latitude, is particularly interesting. The highest prominences in 1886 occurred in latitudes 18° N. and 37° S., whilst there were secondary maxima in 45° N. and 8° S., and tertiary maxima in 80° N. and 75° S. The secondary maxima do not fall far below the principal ones, but the tertiary maxima are not nearly so well marked.